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# CEYLON CLONES. I

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## FOREWORD

THIS article, which gives yield records and other information of Ceylon clones test-tapped in 1932, is the first of a series of annual reports which will increase in interest and importance in successive years. Until recently no clones raised from Ceylon mother-trees have been old enough for test-tapping, and estates have had to rely on importations from Malaya and the Dutch East Indies for the supply of proved high-yielding planting material. There can be no doubt that Ceylon possesses as good potential clones as any other country, and it is clear that the most reliable material for use in the Island will be that which has been tested and proved under the conditions in which it is to be grown. Special interest, therefore, is attached to the performance of Ceylon and foreign clones tested under Ceylon conditions. At the present time the number of Ceylon clones under test-tapping is small, and in no case are the budgrafts old enough for the records to be considered as more than preliminary indications of future potentialities. During the course of the next few years, however, a large number of clones on estates and at the Rubber Research Scheme Experiment Station will come into tapping, and it should soon be possible to recommend Ceylon material of proved high-yielding capacity.

Particulars are given in this report of clones established at the Rubber Research Scheme Experiment Station, Nivitigalakele, and on estates which are co-operating with the Research Scheme in this work. Such co-operation would appear to be mutually advantageous to the Research Scheme and to the estates concerned, and records of any budgrafts which may be in tapping on estates will be welcomed.

Acknowledgment is here made to the undermentioned proprietors who have kindly given permission for the publication of the records of clones established from mother-trees on their properties:

The Govinna Rubber Company, Limited.
The Lavant Rubber Company, Limited.
The Mirishena (Kalutara) Rubber Company, Limited.
Mr. C. E. A. Dias.

## PRESENTATION OF RESULTS

In presenting the yield records and other information the following report is divided into sections according to where the clones are planted. Thus clones tapped at the Rubber Research Scheme Experiment Station are considered together, although the mother-trees are situated on various estates in different districts. Each clone is named according to the name and number of the estate mother-tree from which it is derived, and for convenience an official abbreviation is used.

The unit of measurement chosen for representing yield is grams of dry rubber per tapping. In practice the total weight of rubber obtained in the year is probably of greater interest to the planter, and when possible this figure will be given in subsequent years. In 1932, however, the number of tappings for all clones mentioned in this report was relatively small, and the figures for total yield of rubber in the year would have little significance.

Another yield unit introduced in this report is yield per foot of tapping cut. Although this measure is of no great interest with very young trees it will be of considerable value with older buddings as a means of comparing clones planted under different growth conditions or tapped on varying proportions of the circumference.

The yield data, together with measurements of girth and length of tapping cut, are given in Tables I-VI. Figures for thickness of primary and renewing bark are also shown in the same tables.

It is emphasised that the yielding capacity of a clone is by no means the only important criterion of its economic value. Rate and habit of growth, resistance or susceptibility to disease and wind damage, bark renewal, wound recovery, colour and quality of rubber, etc. are all important considerations in respect of which individual clones exhibit variation, and although it should eventually be possible to select clones which show to advantage in all respects, in the meantime it might be preferable to chose a moderate yielding clone which gives the minimum trouble in upkeep and attention. Notes on these points are accordingly being compiled for individual clones, and the information given in this report will be added to in future years.

## CLONES AT RUBBER RESEARCH SCHEME EXPERIMENT STATION, NIVITIGALAKELE

### GENERAL NOTES

The Experiment Station, Nivitigalakele, was opened in three clearings, in 1926, 1927 and 1928 respectively, with the primary object of testing clones established from high-yielding mother-trees on Ceylon estates. A full account of the development and work at the Station is given in Rubber Research Scheme *Quarterly Circular* Vol. 8, Parts 2 and 3, but a brief statement of the planting history and conditions of the 1926 clearing, the area in which the clones so far test-tapped are planted, will not be out of place.

*Clearing, Planting, Budding.*—This area, about 12 acres in extent, was cleared from jungle in 1926 and planted on contour platforms at approximately 106 trees per acre. Six acres were planted in July 1926, with stumps raised from seed of known mother-trees at Peradeniya and Heneratgoda, and the remainder was planted with basket plants, also from known mother-trees, in October-November, 1926. Budding in the field was commenced in May 1927, but owing to poor growth of the stocks and the difficulty of budding on to transplanted stumps the early results were disappointing. This, in conjunction with scarcity of budwood from suitable mother-trees, has resulted in slow and uneven development in the clearing with the consequence that only 19 budgrafts were large enough to be test-tapped in April 1932.

*Distribution of Clones.*—The original intention to allot 100 trees to each clone was followed out with 11 clones, the trees of each clone being scattered throughout the clearing so as to obtain all combinations of stock and scion. The clearing was completed with 6 further clones represented by a small number of trees each, a number of unbudded seedlings being left as a control.

*Soil Manuring.*—The area over which the trees test-tapped in 1932 are distributed is approximately six acres. The soil in this portion of the Station is a very poor "cabooky" sub-soil containing little or no humus. Great difficulty was at first experienced in establishing green manures and cover-crops, but there is now a fair cover in most parts. As mentioned above early growth of the rubber was slow, but applications of manure and other cultural operations have effected a marked improvement. The

area in which the tapped trees are situated was manured with calcium cyanamide in June 1928, and with general mixtures in September 1928, September 1929, and September 1931.

*Tapping*.—Test-tapping was commenced in October 1931, all trees being tapped with a girth of 16 ins. or more at a height of three ft. from the union. The trees were tapped in October and December 1931, and were then rested until April 1932, when further trees were taken into tapping. Altogether 19 budgrafts representing six clones were tapped as from April 1932. The yield of only two clones, viz. Govinna 771 and Lavant 28 (abbreviated to G. 771 and LAV. 28) are given in this report, the yields from the other clones being too small to be of interest. The latter yields, however, will be given in subsequent reports should later records show promise.

Tapping of the budgrafts was carried out on alternate days on a half-spiral, the cut being opened at an angle of 25° at a height of 48 ins. from the union. Bark consumption was at the rate of about 6 ins. per annum. As will be seen in Tables I and II the number of tappings during the period April-December 1932, was only 86, this relatively small number being accounted for by the interference to tapping caused by the exceptionally wet weather in the latter half of the year. Only full tappings have been included in the records though on some days the trees were tapped late in the morning.

*Recording*.—The method of recording yields at the Station is as follows:

The latex from each tree is coagulated in the cup by the tapper, and the coagulum is squeezed out as thin as possible and hung on a sheltered wire support near the tree. At the end of each month the samples are transferred to a wire bearing the number of the tree and, after drying in a smokehouse, are brought to the laboratories to be weighed. Each day's biscuit contains the scrap from the previous tapping. In order to determine the dry rubber content periodic measurements of the latex were made, but on account of the small yields from each individual tree the figures for 1932 were not altogether satisfactory and are not given in this report. Accurate determinations will be made for promising clones in future years.

The yields for 1932 of the individual trees of clones G. 771 and LAV. 28 are given in Tables I and II, the monthly and annual averages being expressed in grams of dry rubber per

tapping. Figures for girth and length of tapping cut are also given and the yield per foot of cut has been calculated. The tables also include measurements of the thickness of primary and renewing bark.

## NOTES ON INDIVIDUAL CLONES

*Clone G. 771.*—Reference to table I will show that the average yield per tapping for the seven trees for the period April-December 1932, was 13·1 grams, the average age being about five years from the time of budding. This figure compares favourably with the early yields of the proved A.V.R.O.S. clones on the basis of either age or circumference, and it is satisfactory to note a steady increase in yield throughout the year. It is impossible to predict the future potentialities of a clone as the result of one year's tapping at this tender age, but we may say that Clone G. 771 shows distinct promise.

Habit and rate of growth are satisfactory. The trees have an upright branching system, i.e. the branches tend to grow vertically rather than to spread horizontally. This seems to be an advantage as enabling a greater density of planting.

Primary bark is rather thin but renewal is very good. The figures given in table I show that after ten months the average thickness of renewing bark is 87 per cent. of that of the primary bark.

One case of pink disease has occurred out of the total number of 105 trees in the clone, but no other trouble with disease or wind damage is to be reported.

The only defects which have so far developed concern the behaviour of the latex; this continues to flow from the trees until late in the morning, and at the same time there is a marked tendency to early clotting. It remains to be seen whether these defects persist when the trees are mature and are sufficiently troublesome to offset other good qualities.

*Clone LAV. 28.*—The average yield for the four trees in tapping was 8·6 grams (see Table II). This figure is rather lower than the yield of most of the proved foreign clones at a corresponding age or size, but a satisfactory increase throughout the year is to be noted.

The trees of this clone show strong growth, the crown being large with a spreading branching system. Primary bark is of a good thickness and renewal is excellent. Four cases of pink disease have occurred.

## TABLE I

### *Clone Govinna 771*

| Tree No. | Date of budding | Girth at 3 ft. on 1-10-32 | | Average yield in grams dry rubber per tapping | | | | | | | | | Average per tapping for year | Length of tapping cut on 1-10-32 | Average yield per ft. of tapping cut | Thickness of bark | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1932 | | | | | | | | | | | | Primary at 3 ft. on 14-2-33 | Renewing, 10 months' renewal |
| | | | | April | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | | | | | |
| | | | | Number of tappings | | | | | | | | | Total | | | | |
| | | ins. | cms. | 8 | 9 | 10 | 12 | 9 | 9 | 5 | 10 | 14 | 86 | ins. | grams | mms. | mms. |
| 38 | 9-8-27 | 17·75 | 45·1 | 6·4 | 5·9 | 7·6 | 10·5 | 11·4 | 13·6 | 17·7 | 19·1 | 16·8 | 12·2 | 10·0 | 14·6 | 6·0 | 5·0 |
| 91 | 9-8-27 | 19·0 | 48·3 | 5·4 | 6·7 | 9·7 | 9·9 | 9·1 | 14·6 | 13·9 | 20·8 | 16·9 | 12·2 | 10·75 | 13·6 | 5·5 | 5·0 |
| 98 | 9-8-27 | 19·75 | 50·2 | 7·4 | 6·7 | 7·3 | 11·1 | 11·1 | 21·0 | 21·7 | 24·9 | 20·5 | 14·6 | 11·25 | 15·6 | 5·5 | 4·5 |
| 199 | 9-8-27 | 19·5 | 49·5 | 9·5 | 9·0 | 9·6 | 12·1 | 13·0 | 22·0 | 25·5 | 26·5 | 22·3 | 16·5 | 11·25 | 17·6 | 5·0 | 4·5 |
| 386 | 26-5-27 | 20·5 | 52·1 | 5·4 | 5·2 | 5·7 | 8·0 | 8·9 | 16·1 | 14·6 | 18·8 | 13·0 | 10·6 | 11·5 | 11·1 | 6·0 | 4·0 |
| 403 | 25-7-28 | 20·0 | 50·8 | 4·3 | 4·9 | 6·5 | 10·1 | 8·1 | 16·0 | 22·0 | 29·5 | 19·2 | 13·4 | 10·75 | 14·9 | 4·5 | 5·5 |
| 558 | 10-8-27 | 18·0 | 45·7 | 8·9 | 8·0 | 7·9 | 9·6 | 11·2 | 12·5 | 16·2 | 20·9 | 13·7 | 12·0 | 9·75 | 14·8 | 5·5 | 4·5 |
| Average for clone | | 19·2 | 48·8 | 6·8 | 6·6 | 7·8 | 10·2 | 10·4 | 16·5 | 18·8 | 22·9 | 17·5 | **13·1** | 10·75 | 14·6 | 5·4 | 4·7 |

## TABLE II

*Clone Lavant 28*

| Tree No. | Date of budding | Girth at 3 ft. on 1-10-32 | | Average yield in grams dry rubber per tapping. 1932 | | | | | | | | | Average per tapping for year | Length of tapping cut on 1-10-32 | Average yield per ft. of tapping cut | Thickness of bark | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | April | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | | | | Primary at 3 ft. on 14-2-33 | Renewing, 10 months' renewal |
| | | | | Number of tappings | | | | | | | | | Total | | | | |
| | | ins. | cms. | 8 | 9 | 10 | 12 | 9 | 9 | 5 | 10 | 14 | 86 | ins. | grams | mms. | mms. |
| 131 | 9-11-27 | 25·75 | 65·4 | 7·0 | 7·1 | 7·5 | 8·2 | 8·1 | 12·3 | 17·0 | 24·7 | 19·6 | 12·6 | 13·5 | 11·2 | 8·0 | 5·5 |
| 260 | 10-11-27 | 19·5 | 49·5 | 2·5 | 3·1 | 4·3 | 5·1 | 4·7 | 6·3 | 9·3 | 16·5 | 10·7 | 7·1 | 11·0 | 7·7 | 7·0 | 6·0 |
| 339 | 10-11-27 | 21·75 | 55·2 | 4·1 | 2·9 | 3·0 | 4·2 | 4·3 | 4·5 | 5·6 | 9 7 | 14 5 | 6·4 | 10·25 | 7·5 | 6·0 | 6·5 |
| 443 | 2-8-28 | 19·25 | 48·9 | 5·8 | 7·1 | 7·8 | 7·0 | 5·5 | 5·7 | 8·3 | 8·6 | 14·7 | 8·2 | 10·0 | 9·8 | 6·0 | 4·0 |
| Average for clone | | 21·6 | 54·8 | 4·8 | 5·0 | 5·6 | 6·1 | 5·6 | 7·2 | 10·0 | 14·9 | 14·9 | **8·6** | 11·2 | 9·0 | 6·75 | 5·5 |

TAB

*Clone Hi*

| Tree No. | Date of budding | Girth at 3 ft. on 27-7-32 | | Average yield in grams dry rubber per tapping | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1931 | | 1932 | | | | | |
| | | | | Aug.-Sep. | Dec. | April | May | June | July | Aug. | Sep |
| | | | | Number of tappings | | | | | | | |
| | | ins. | cms. | 11 | 15 | 12 | 4 | — | 7 | 8 | 5 |
| 1 | Sept. 1926 | 26·0 | 66·0 | 13·4 | 22·3 | 34·9 | 48·0 | — | 41·7 | 39·0 | 46·6 |
| 2 | do | 23·0 | 58·4 | — | 14·9 | 31·5 | 40·2 | — | 37·5 | 34·0 | 40·2 |
| 3 | do | 23·5 | 59·7 | 13·4 | 21·8 | 36·4 | 40·7 | — | 38·3 | 39·0 | 45·6 |
| 4 | do | 21·5 | 54·6 | 7·1 | 15·1 | 24·2 | 28·5 | — | 28·3 | 26·0 | 32·4 |
| 5 | do | 22·0 | 55·9 | 8·1 | 14·3 | 26·6 | 32·0 | — | 29·2 | 31·0 | 39·6 |
| 6 | do | 23·5 | 59·7 | 9·0 | 15·3 | 26·2 | 31·7 | — | 30·0 | 28·0 | 33·2 |
| 7 | do | 26·0 | 66·0 | 9·1 | 20·9 | 32·1 | 36·5 | — | 38·3 | 32·0 | 36·2 |
| 8 | do | 23·0 | 58·4 | 9·3 | 19·1 | 33·8 | 40·7 | — | 43·3 | 42·0 | 45·1 |
| 9 | do | 22·5 | 57·2 | 9 3 | 14·9 | 23·6 | 25·4 | — | 26·7 | 26·0 | 33·2 |
| 10 | do | 22·5 | 57·2 | 10·3 | 12·9 | 21·0 | 28·9 | — | 30·0 | 31·0 | 32·4 |
| 11 | do | 23·5 | 59·7 | 8·6 | 19·7 | 31·2 | 31·6 | — | 37·5 | 32·0 | 34·1 |
| 12 | do | 25·5 | 64·8 | 6·7 | 22·3 | 33·3 | 43·0 | — | 34·2 | 31·0 | 40·1 |
| Average for clone | | 23·8 | 60·5 | 10·4 | 17·8 | 29·6 | 35·6 | — | 35·7 | 34·5 | 38· |

| Oct. | Nov. | Dec. | Average per tapping for 1932 Total | Length of tapping cut on 27-7-32 | Yield per ft. of cut. Average for 1932 | Average dry rubber content | Thickness of bark: Primary at 8 ft. on 10-2-33 | Thickness of bark: Renewing 10 months' renewal. |
|---|---|---|---|---|---|---|---|---|
| 4 | 5 | 10 | 55 | ins. | grams | per cent. | mms. | mms. |
| 50·4 | 62·4 | 86·8 | 52·4 | 15·0 | 41·9 | 37·1 | 7·5 | 4·5 |
| 51·1 | 62·8 | 73·1 | 45·9 | 13·0 | 42·4 | 37·7 | 6·5 | 5·0 |
| 41·7 | 55·6 | 65·9 | 45·7 | 14·0 | 39·2 | 37·1 | 7·0 | 4·5 |
| 37·7 | 50·6 | 57·7 | 35·5 | 13·0 | 32·8 | 37·2 | 7·0 | 5·0 |
| 40·7 | 48·8 | 59·8 | 38·2 | 13·5 | 33·9 | 36·8 | 7·5 | 4·0 |
| 35·8 | 47·0 | 55·4 | 35·9 | 13·75 | 31·3 | 36·8 | 7·0 | 5·5 |
| 38·0 | 59·2 | 72·3 | 43·8 | 15·25 | 34·6 | 36·7 | 8·0 | 5·0 |
| 46·8 | 67·6 | 77·5 | 49·7 | 12·75 | 46·8 | 35·4 | 7·0 | 4·0 |
| 36·6 | 39·6 | 54·3 | 33·3 | 13·25 | 30·2 | 38·4 | 7·5 | 5·0 |
| 32·5 | 39·2 | 55·3 | 33·9 | 13·5 | 30·1 | 38·4 | 6·5 | 7·0 |
| 36·8 | 47·2 | 68·7 | 41·1 | 13·25 | 37·2 | 38·3 | 7·0 | 6·0 |
| 42·0 | 53·4 | 63·8 | 42·4 | 13·5 | 37·7 | 37·2 | 7·0 | 4·5 |
| 41·0 | 53·1 | 65·9 | 41·9 | 13·6 | 37·0 | 37·1 | 7·1 | 5·0 |

## GENERAL NOTES

A number of clones from high-yielding mother-trees on Hillcroft Estate were established on Stenness Estate in the Kalutara district in 1926, budding being carried out in the field in September of that year. Tapping of some of these clones was commenced in 1931, and we are much indebted to Mr. L. P. Gapp who from the commencement of test-tapping has co-operated fully with the Research Scheme in keeping the records. Particulars of two clones, Hillcroft 28 and 34 (HC. 28 and 34), are given in this report.

Stenness Estate was cleared from jungle in 1925 and consists at present of an irregularly mixed planting of seedlings and buddings of unproved clones, the stand being approximately 90 trees per acre. The land is undulating, the ground having at the present time a moderate cover of leguminous species and weeds. The areas containing the trees in tapping were manured in 1926, 1928, 1930 and 1931.

The trees in tapping of Clone HC. 28 are distributed over an area of about two acres, while those of HC. 34 are contained in one acre.

*Tapping.*—Tapping of Clones HC. 28 and 34 was commenced in August 1931. The trees were tapped in August-September and December 1931, and were then rested until April 1932. As at the Rubber Research Scheme Experiment Station tapping was on a half-spiral cut, commencing at a height of 48 ins. from the union measured from the top of the cut, the angle of slope being 25°. The rate of bark consumption during 1932 is somewhat difficult to calculate owing to the irregular tapping intervals, but it approximates to 9 ins. per annum calculated on a normal number of tappings.

Tapping was carried out on alternate days, but the trees were only tapped during good weather. As a consequence of the heavy rainfall during the latter half of 1932 the number of recorded tappings during the period April-December is only 55 and 54 for Clones 28 and 34 respectively, and the tapping system is actually equivalent to alternate day in alternate months. The trees were not tapped at all in June and in most other months there were intervals of 10-20 days in which the trees were rested.

Account must be taken of this mild system when considering the figures for average yield per tapping. The trees were tapped on a few additional occasions when "washouts" occurred, but only full tappings have been included in the records.

*Recording.*—The latex from each tree is brought in the cup to a shed, and, after being measured in cubic centimetres, is coagulated in the cup, the latter being marked with the number of the tree. The separate biscuits are strung on a wire for each tree, and at the end of the month are sent to the Rubber Research Scheme Laboratories to be weighed. The separate pieces of rubber are creped together for each tree, and this weight divided by the number of tappings gives the average yield per tapping for the month. Scrap rubber is not included. The daily measurements of latex are also received and the average dry rubber content calculated therefrom.

From the foregoing it can be seen that the recording of the yields from the Hillcroft clones is under the close supervision of the Rubber Research Scheme.

*Quality of Rubber.*—A preliminary investigation of the quality of the rubber from Clones HC. 28 and 34 has been carried out by the London Staff of the Scheme, and their report indicates that the inner properties are satisfactory in view of the age of the trees. Further tests will be carried out when the trees are older.

## NOTES ON INDIVIDUAL CLONES

*Clone HC. 28.*—The monthly averages of the individual trees for 1931 and 1932 are given in Table III. It will be noted that the average for the clone for the period April-December 1932, reached the high figure of 41·9 grams (nearly 1½ oz.), which represents a remarkable increase as compared with the first tappings.

In considering the figure for average yield per tapping the small number of recorded tappings must, however, be borne in mind. Had tapping been carried out on commercial lines the total yield for the year would have been much larger, but the average per tapping would in all probability have been rather smaller. 1932 was an exceptionally wet year, and it is hoped that in 1933 rain will not interefere with tapping to the same extent. There is no doubt that the clone is of outstanding

promise, and should a further year's records with a full number of tappings show a normal yield increase, the clone will have established itself as of economic value.

The growth of this clone is good, but the trees on Stenness Estate have inherited and accentuated a spiral fluting of the mother-tree. The twisting of the trees is very marked, but tapping will not be interfered with unless this feature becomes more pronounced as the trees mature. It seems probable that the phenomenon is related to the fact that the buds were taken from unpollarded wood, for on other estates where pollarded wood was used in establishing this clone the plants are growing quite straight.

The clone has not developed any other defects. Primary and renewing bark are satisfactory, and with the exception of bark rot on the tapping panels during wet weather in September 1931, no diseases have been reported. The average dry rubber content for 1932 was 37·1 per cent.

*Clone HC. 34.*—Reference to Table IV shows that the average yield per tapping for this clone in 1932 was 31·4 grams. The yield, though lower than that of HC. 28, is yet very high for the age of the trees, and it will be seen that if the length of tapping cut is taken into consideration the yield per foot of cut is nearly as great as for HC. 28. Despite this promising yield, however, the clone posseses defects which render its future economic value doubtful.

In the first place growth is very poor, the average girth at a height of three feet being only 48·1 cms. as compared with 60·5 cms. for HC. 28, the two clones being of the same age. The fact that trees are small is of itself no disadvantage as it would allow of a larger number of trees to be planted per acre, but slow growth of young buddings is usually attended by an increase in the amount of care and attention necessary in early years. There is a marked tendency for the bark to split, leaving vertical wounds in which the wood is exposed, and the trees seem to be rather susceptible to bark rot. The rubber, also, is dark in colour and difficulty might be experienced in crepe manufacture.

In other respects the clone is satisfactory, and it remains to be seen whether its defects are sufficiently important to offset the high-yielding capacity.

TABLE

*Clone Hill*

| Tree No. | Date of budding. | Girth at 3 ft. on 27-7-32 | | Average yield in grams dry rubber per tapping | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1931 | | 1932 | | | | | |
| | | | | Aug.-Sep. | Dec. | April | May | June | July | Aug. | Sep. |
| | | | | Number of tappings | | | | | | | |
| | | ins. | cms. | 11 | 14 | 11 | 4 | — | 7 | 8 | 5 |
| 1 | Sept. 1926 | 19·0 | 48·3 | 11·8 | 16·5 | 18·4 | 20·4 | — | 20·0 | 26 0 | 26·2 |
| 2 | do | 17·0 | 43·2 | 7·6 | 16·6 | 16·5 | 15·9 | — | 15·0 | 18·7 | 21·8 |
| 3 | do | 20·5 | 52·1 | 17·1 | 31·0 | 29·3 | 31·6 | — | 32·2 | 40·0 | 41·2 |
| 4 | do | 17·5 | 44·5 | 14·9 | 23·2 | 22·1 | 27·6 | — | 20·0 | 26·0 | 35·8 |
| 5 | do | 19·5 | 49·5 | 10·1 | 18·5 | 24·6 | 26·4 | — | 18·3 | 23·0 | 27·0 |
| 6 | do | 19·0 | 48·3 | 13·5 | 21·4 | 20·3 | 21·0 | — | 21·7 | 29·0 | 35·0 |
| 7 | do | 20·0 | 50·8 | 13·8 | 21·4 | 20·9 | 26·2 | — | 23·3 | 28·0 | 37·2 |
| Average for clone | | 19·0 | 48·1 | 12·7 | 21·2 | 23·2 | 24·2 | — | 23·5 | 28·4 | 32·0 |

promise, and should a further year's records with a full number of tappings show a normal yield increase, the clone will have established itself as of economic value.

The growth of this clone is good, but the trees on Stenness Estate have inherited and accentuated a spiral fluting of the mother-tree. The twisting of the trees is very marked, but tapping will not be interfered with unless this feature becomes more pronounced as the trees mature. It seems probable that the phenomenon is related to the fact that the buds were taken from unpollarded wood, for on other estates where pollarded wood was used in establishing this clone the plants are growing quite straight.

The clone has not developed any other defects. Primary and renewing bark are satisfactory, and with the exception of bark rot on the tapping panels during wet weather in September 1931, no diseases have been reported. The average dry rubber content for 1932 was 37·1 per cent.

*Clone HC. 34.*—Reference to Table IV shows that the average yield per tapping for this clone in 1932 was 31·4 grams. The yield, though lower than that of HC. 28, is yet very high for the age of the trees, and it will be seen that if the length of tapping cut is taken into consideration the yield per foot of cut is nearly as great as for HC. 28. Despite this promising yield, however, the clone posseses defects which render its future economic value doubtful.

In the first place growth is very poor, the average girth at a height of three feet being only 48·1 cms. as compared with 60·5 cms. for HC. 28, the two clones being of the same age. The fact that trees are small is of itself no disadvantage as it would allow of a larger number of trees to be planted per acre, but slow growth of young buddings is usually attended by an increase in the amount of care and attention necessary in early years. There is a marked tendency for the bark to split, leaving vertical wounds in which the wood is exposed, and the trees seem to be rather susceptible to bark rot. The rubber, also, is dark in colour and difficulty might be experienced in crepe manufacture.

In other respects the clone is satisfactory, and it remains to be seen whether its defects are sufficiently important to offset the high-yielding capacity.

| Oct. | Nov. | Dec. | Average per tapping for 1932 Total | Length of tapping cut on 27-7-32 | Yield per ft. of cut. Average for 1932 | Average dry rubber content | Thickness of bark: Primary at 3 ft. on 10-2-33 | Thickness of bark: Renewing 10 months' renewal |
|---|---|---|---|---|---|---|---|---|
| 4 | 5 | 10 | 54 | ins. | grams | per cent. | mms. | mms. |
| 34·1 | 38·4 | 42·1 | 28·0 | 10·0 | 33·6 | 38·0 | 6·5 | 5·0 |
| 20·5 | 33·4 | 25·8 | 20·7 | 9·25 | 26·8 | 36·7 | 6·0 | 4·0 |
| 44·8 | 59·0 | 54·4 | 41·1 | 11·5 | 42·9 | 36·4 | 6·5 | 4·5 |
| 32·5 | 40·0 | 42·5 | 30·8 | 10·0 | 36·4 | 36·8 | 6·5 | 4·0 |
| 29·9 | 34·4 | 40·1 | 28·1 | 10·75 | 31·4 | 39·2 | 6·5 | 4·0 |
| 39·2 | 52·8 | 49·8 | 33·1 | 10·5 | 37·8 | 37·4 | 5·0 | 5·0 |
| 32·3 | 39·4 | 54·4 | 32·7 | 10·5 | 37·4 | 39·4 | 6·0 | 4·5 |
| 33·4 | 43·0 | 44·1 | 31·4 | 10·4 | 35·2 | 37·6 | 6·1 | 4·4 |

## MILLENIYA AND WAWULUGALA CLONES

### GENERAL NOTES

In this section are included clones derived from mother-trees on Milleniya and Wawulugala Estates. Particulars are given below of four clones established and tapped in clearings on both the above estates, and it is convenient to consider the clones from both estates together. Many other clones are being tapped but at present the yields do not appear sufficiently promising for publication. We are indebted to Mr. C. E. A. Dias, the proprietor of the estate, for giving us access to his yield records.

The clearing on Milleniya consists of 27 acres of gently undulating land opened from small jungle in 1924. Seed was planted in 1924, but there was a high percentage of casualties, the vacancies being supplied with stumps in 1925. The clones mentioned in this report were budded in 1927. The soil is gravelly, probably average for the district, and has been improved by a thick cover of leguminous species, mostly *Pueraria phaseoloides*. Growth of the budgrafts has been uniformly good.

On Wawulugala Estate an area of about three acres of cinnamon and coconut land was cleared and planted with stumps in 1926, budding being done in 1927. The clearing is low-lying deniya land with a sandy soil, but growth has up to the present been very satisfactory.

*Tapping.*—Tapping was commenced in both clearings in 1930, but the trees were then so young that the records are not considered of sufficient interest for inclusion in this report. In 1931 tapping was carried out in the months October-December, the system being one half-spiral cut on alternate days. In 1932 the trees were rested until October (on Milleniya Estate until November) when tapping was resumed on two half-spiral cuts on opposite sides every three days. The heights of the two cuts were 40 ins. and 18 ins. respectively, measured from the top of the cut to the union. Bark consumption is at the rate of about $\frac{1}{2}$ inch per month on each cut; a figure for annual consumption cannot be given at present since it is intended to combine the tapping system with a periodic interval of rest.

The influence of this "double-cut" system on yield is discussed below.

*Recording.*—The latex from each tree is coagulated in the cup and each day's "biscuit", containing the scrap from the previous tapping, is hung on a wire near the tree. At the end of the month the biscuits from all trees of the same clone are rolled together, and the resultant sheet dried and weighed. Thus yields from individual trees have not hitherto been kept. Up to the present the yield recording has not been supervised by the Research Scheme, but in future the rubber is to be sent monthly to the laboratories to be weighed.

Table V shows the number of trees under test to be ten for each clone in the two clearings. The total number of trees tapped, however, is considerably larger, and the yields for 1931 were actually obtained from a varying number of trees in the different clones.

*Yields.*—The comparison of these yields under the "double-three" system of tapping with those of other Ceylon and foreign clones tapped on a single cut is somewhat difficult and uncertain. No information regarding the reaction of young budgrafts to this tapping system is available, but with mature seedlings it has been found that the average yield per tapping on two half-spiral cuts every three days (combined with alternate periods of six months' tapping and rest) is about 2·4 times as great as the yield on a single cut on alternate days. It is possible that this figure may need modification when applied to young budgrafts in general, and a differential response with different clones is certainly to be expected. Bearing in mind, however, that the trees in question received the benefit of nine to ten months' rest prior to opening the cuts in 1932, it seems probable that to effect a comparison with yields obtained on a single cut the figures shown in Table V should be divided by at least two. The figures for yield per foot of cut are here useful, but even so the fact that the tapping interval is three instead of two days must be taken into consideration.

On the basis of the above considerations the yields for 1932 are comparable with those of the best A.V.R.O.S. clones at a similar age. It would be unwise at this stage to place much reliance on the comparison of individual clones, but so far as can be judged at present Clones M.191, W.259 and W.320 appear to show the most promise.

## NOTES ON INDIVIDUAL CLONES

*Clone M.191.*—With an average of 39·2 grams per tapping for the period October-December 1932, this is the highest yielding clone tapped on Wawulugala. The trees, however, are exceptionally big for their age and the yield per foot of tapping cut is not so high as for some other clones.

Growth of this clone is exceptionally rapid, and both primary and renewing bark are satisfactory.

*Clone W.120.*—The trees of this clone are very uniform in growth and have an extremely straight stem. The yield, however, is not very promising.

*Clone W.259.*—The average yield for the trees on both estates for the tapping period in 1932 was 34·1 grams per tapping.

Growth is very good, the trees having a straight stem with a moderate crown. Some of the trees are reported to drip late into the morning.

*Clone W.320.*—As the girth measurements indicate the trees of this clone are smaller than any of the other clones, and on account of the shorter tapping cuts the yield per foot is correspondingly high. Despite the slow growth it is reported that no trouble with the young buddings was experienced, and it is possible that the small size of the trees may be an advantage in enabling a greater density of planting. This would also be helped by the upright branching habit.

One case of damage due to wind has been noted, and bark rot occurred on a few trees in November 1931.

# TABLE V

## *Milleniya and Wawulugala Clones*

| Clone | Where planted | No. of trees | When budded | Average girth at 40 ins. Jan. 1932 ins. | Jan. 1932 cms. | Feb. 1933 ins. | Feb. 1933 cms. | Average yield per tapping in grams dry rubber and number of tappings for periods: 1931 Oct.-Dec. Yld | 1931 Oct.-Dec. Tpgs | 1932 October Yld | 1932 October Tpgs | 1932 November Yld | 1932 November Tpgs | 1932 December Yld | 1932 December Tpgs | 1932 Oct.-Dec. Yld | 1932 Oct.-Dec. Tpgs | Average length of tapping cuts in Feb. 1933 ins. | Average yield per ft. of cut for 1932 grams. | Thickness of Bark: Primary at 3 ft. on 22-3-33 mms. | Thickness of Bark: Renewing, 17 months' renewal mms. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M. 191 | M | 10 | Sep.-Dec. 1927. | | | 23·1 | 58·7 | 6·0 | | | | not tapped | | | | | | 22·6 | | 7·1 | 6·0 |
| | W | 10 | Aug.-Oct. 1927. | 20·0 | 50·8 | 27·3 | 69·3 | 12·8 | 35 | 30·7 | 5 | 44·5 | 8 | 39·2 | 9 | 39·2 | 22 | 28·1 | 16·7 | 6·8 | 6·0 |
| W. 120 | M | 10 | Sep.-Dec. 1927. | | | 21·6 | 54·9 | 5·3 | | | | 26·4 | 9 | 19·4 | 10 | 22·7 | 19 | 21·4 | 12·7 | 7·2 | 5·6 |
| | W | 10 | August 1927. | 16·6 | 42·2 | 22·5 | 57·1 | 8·6 | 35 | 15·0 | 5 | 26·8 | 8 | 28·3 | 9 | 24·7 | 22 | 23·2 | 12·8 | 6·1 | 4·6 |
| W. 259 | M | 10 | Sep.-Dec. 1927. | | | 22·9 | 58·2 | 8·7 | | | | 40·5 | 9 | 29·5 | 10 | 34·7 | 19 | 21·2 | 19·6 | 7·4 | 6·2 |
| | W | 10 | May-Sep. 1927. | 16·6 | 42·2 | 24·1 | 61·2 | 11·3 | 35 | 20·9 | 5 | 36·5 | 8 | 37·9 | 9 | 33·5 | 22 | 23·1 | 17·4 | 7·0 | 5·2 |
| W. 320 | M | 10 | Sep.-Dec. 1927. | | | 21·0 | 53·3 | 9·2 | | | | 32·9 | 9 | 36·6 | 10 | 34·8 | 19 | 20·4 | 20·5 | 6·8 | 5·2 |
| | W | 10 | Aug.-Sep. 1927. | 15·5 | 39·4 | 20·5 | 52·1 | 13·9 | 35 | 28·5 | 5 | 37·7 | 8 | 33·0 | 9 | 33·7 | 22 | 21·1 | 19·2 | 6·2 | 5·1 |

*Tapping Systems* 1931 Half-spiral alternate day.
1932 Two half-spirals opposite sides every 3 days.

M = Milleniya.
W = Wawulugala

## CLONE HENERATGODA 2

The justification for publishing yield records of this clone must be sought in the fame of the mother-tree and the wide interest taken in its progeny. Records of one tree tapped at Nivitigalakele and of ten trees tapped on Milleniya Estate are given in Table VI, but the yields obtained to date are not encouraging. It is to be noted that the trees on Milleniya Estate are tapped on two half-spiral cuts every three days.

## TABLE VI

### *Clone Heneratgoda 2*

| Clone | Where planted | No. of trees | When budded | Girth at 40 ins. in February 1933 | | Tapping system | Average yield in grams dry rubber per tapping | | | | | | | | | Average per tapping for year | Length of tapping cut | Average yield per ft. of cut |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1932 | | | | | | | | | | | |
| | | | | | | | April | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | | | |
| | | | | | | | Number of tappings | | | | | | | | | Total | | |
| | | | | ins. | cms. | | 8 | 9 | 10 | 12 | 9 | 9 | 5 | 10<br>9 | 14<br>10 | 86<br>19 | ins. | grams |
| H. 2 | Nivitigalakele. | 1 | Aug. 1927 | 19·0 | 48·3 | ½ spiral alt. day | 2·2 | 1·9 | 3·0 | 3·8 | 4·6 | 3·3 | 4·1 | 8·3 | 10·1 | **5·0** | 9·5 | 6·3 |
| H.2 | Millaniya | 10 | July-Sept. 1926 | 22·9 | 58·2 | two ½ spirals every 3 days. | Not tapped | | | | | | | 22·6 | 25·5 | **24·1** | 22·5 | 12·9 |

# A NOTE ON SUN-SCORCH OF BUDGRAFTS

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## FOREWORD

IN a previous report [1] a brief description was given of damage due to sun-scorch of the callus bark near the union of young budgrafts, this form of injury having occurred on several estates during the exceptional drought experienced in January and February 1932. During the hot weather of March 1933, similar symptoms were observed on a number of budgrafts two to four years of age at the Experiment Station, Nivitigalakele. In most cases a cavity due to the decay of the stock snag had been filled some months earlier with a plastic mixture of Colas and sand, and it appeared that this filling, which absorbs a considerable amount of heat when exposed to a hot sun, had contributed to and accentuated the damage. The use of this Colas-sand filling has been tentatively advocated in previous reports [1] [2] and the purpose of this note, therefore, is to describe this manifestation of sun or heat-scorch and to qualify the recommendation.

## SYMPTOMS AND OCCURRENCE

The injury starts as an irregular cracking of the raised bark growing over the cut end of the stock, the cracks developing approximately at right angles to one another. In mild cases only the outer bark is affected and no damage results. More generally, however, the bark dies back to the wood and there is a more or less complete ring of dead discoloured bark around the stock snag. At this stage there is the danger of parasitic fungi gaining entrance, and in several instances *Botryodiplodia Theobromae* has extended the damage several inches up the scion, and into the wood. In the cases examined there was no question of the fungus having gained entrance via the dead stock since the typical bluish-grey discolouration of the wood was isolated from the union by healthy tissue. The majority of affected trees at the Experiment Station, however, have not become invaded by Diplodia and show signs of rapid recovery by renewed callus growth.

Sun-cracking of this nature has only been observed in Ceylon where the raised portion, often described as the "elephant foot", is exposed to the direct rays of the hot mid-day and afternoon sun. No plants which were budded on the south-westerly side of the stock, and whose callus bark on the opposite side is therefore partly shaded at the time of day when the sun is hottest, have been found affected. This suggests that the trouble could be obviated by placing the bud on the south or west side of the stock, and this matter is further discussed below. Under normal conditions sun-scorch is only likely to occur when large stocks are budded since in such cases a delay in covering the stock snag is inevitable, and a relatively large area of callus bark is exposed in a plane nearly at right angles to the direct rays of the sun.

In the majority of cases on the Station a cavity due to the decay of the stock snag had previously been filled with a mixture of Colas and sand in the proportion 1: 2. This is a plastic filling which is gradually extruded by the in-growing callus so that unless it is removed, or until it falls off, the excess lies on the callus bark. The mixture appears to absorb sufficient heat when exposed to the sun to accentuate the scorching. Without a controlled experiment it is impossible to be sure to what extent the Colas-sand mixture has contributed to the damage, but it appears significant that the majority of severe cases are associated with this filling.

## TREATMENT

The treatment of affected trees calls for little comment, and only where the damage has been extended by the invasion of Diplodia is any treatment considered necessary. In such cases all diseased bark should be removed and discoloured wood excised with a chisel. The exposed wood surface, which should be of a healthy colour, is then painted with a 20 per cent. mixture in water or Brunolinum Plantarium (or disinfectant of similar strength), and covered with a waterproof mixture such as Skene's pruning mixture.

## PREVENTION

The obvious means of avoiding sun-scorch is either to orientate the bud so that the callus bark is partly shaded by the stem during the time of day at which the sun is hottest, or to provide an artificial or living shade. The first alternative is subject to the possible objection that it would be necessary to

bud on to the south or west side of the stock whereas it is considered preferable on general grounds to place the bud on the shady side of the stock. Provided the bud and young shoot are well shaded, however, there would appear to be little objection to budding on the sunny side.

The provision of a living shade, consisting of a few plants of an erect green manure planted close to the budgraft on the south side, is the best means of preventing sun-scorch. By sowing seed of a quick growing species a few months before hot weather is anticipated a good shade can be provided until the union of stock and scion has been completed. Where large stocks have been budded this measure can be recommended whether or not the Colas-sand filling has been used, since callus growth is in any event favoured by moist, shady conditions. The provision of shade is clearly of considerable importance in districts where a long period of hot dry weather is annually experienced.

Filling mixtures are now being used experimentally in which the sand is replaced by (1) saw dust and (2) coir dust, and it appears that these mixtures absorb less heat. It will probably be desirable, however, to inspect all treated trees prior to anticipated hot weather and remove any excess filling which has been extruded so as to lie on the callus bark.

## REFERENCES


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2. Pieris, W. I.—Notes on the After-treatment of Budded Rubber Stocks.—Rubber Research Scheme (Ceylon) *Quarterly Circular* Vol. 9, Parts 3 and 4, 1932.

# THE USE OF RECLAIM IN RUBBER MANUFACTURE*

## A CRITICAL EXAMINATION

G. MARTIN, B.Sc., A.I.C., F.I.R.I.,

OF THE SCIENTIFIC STAFF OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA)

THE interest of the rubber grower in the use of reclaimed rubber is based on the assumption that it is a substitute for crepe or sheet. This assumption may not be wholly correct as reclaim is sometimes used for purposes for which raw rubber is stated to be unsuitable, but there is little doubt that in many cases its use reduces the consumption of the plantation product. At present the consumption of reclaim in the U.S.A. is approximately 20 per cent. of that of raw rubber. Owing to its origin, reclaim may contain considerable quantities of compounding ingredients, so that if the whole of the reclaim now employed in industry were replaced by the same amount of raw rubber and compounding ingredients the increased consumption of raw rubber would be less than 20 per cent. and might amount to 10 per cent.

A variety of reasons for using reclaim has been recorded at different times. A few years ago the most important factor in favour of reclaim was its price relative to that of raw rubber. The proportion consumed in the U.S.A. was then more than double what it is at present. Some manufacturers in order to justify the use of such large percentages of reclaim carried out experiments to show that articles made with reclaim were equal in quality to those made with first grade crepe and sheet as long as the amount used was maintained within certain limits and the necessary allowance made for the compounding ingredients which reclaim already contained. This statement did not obtain universal approval amongst manufacturers and subsequent investigations support the view that reclaim has an adverse effect on the quality of the finished article. The considerable reduction in the proportion of reclaim now employed indicates

* Published previously in the *Bulletin of the Rubber Growers' Association*, Vol. 15, No. 5. May, 1933, pp. 265-269.

that the views which some manufacturers held when the price of rubber was high is not the general opinion now that rubber is cheap.

The reason for the continued use of a proportion of reclaim now that the price advantage has largely disappeared may be connected with technical advantages, although of course there are other factors affecting the demand for reclaim. Some grades are cheaper than raw rubber: some manufacturers make their own reclaim and would prefer to keep their plant fully occupied. Moreover, it is not yet clear that the amount of reclaim employed has reached its lowest level. Manufacturers cannot change their mixings without carrying out extensive trials and tests to determine the effect of the change, and they are not likely to initiate these unless there is a prospect of stability in the relative prices of plantation rubber and reclaim. The proportion of reclaim used in the rubber industry only reacts slowly to reductions in the price of raw rubber, and it is not yet clear whether the technical advantages of reclaim are of sufficient value to ensure its continued use in the proportions now employed or whether there is likely to be still further reductions in sympathy with the relative prices of reclaim and raw rubber.

If reclaim possesses technical advantages over raw rubber it is important for the rubber grower to know exactly what they are in order to appreciatate the respects in which raw rubber is unsuitable and how it may be improved. The recent statements concerning the advantages of reclaim mostly refer to the effect of reclaim on the manipulation of rubber. The conversion of crepe and sheet into vulcanised articles necessitates heavy and expensive machinery and it is argued on behalf of reclaim that the amount of manipulation required by mixtures of rubber and reclaim is less than that required by rubber alone, so that although reclaim is in some cases more expensive than raw rubber it is more economical to use mixtures of rubber and reclaim than rubber alone.

None of the recently suggested beneficial effects of reclaim refers to the quality of the finished product. It is now generally admitted that where the maximum tensile strength or resistance to abrasion is required rubber alone is definitely superior to mixtures of rubber and reclaim; but it is claimed that there is a large range of purposes for which the excellent mechanical properties of rubber are not wholly essential and that in these cases

the processing economies effected by reclaim are of sufficient importance to justify its use even when the price of reclaim is higher than that of raw rubber.

British manufacturers who were consulted as to the reason for using reclaim irrespective of price were not very definite as to the technical value of reclaim except for special purposes which do not account for the quantity of reclaim still used in America. They made several suggestions however, and these combined with a study of those technical journals which publish regular notices on behalf of the reclaim industry indicate that there is a possibility of a mixture of reclaim and raw rubber having the following advantages over raw rubber alone:

(1) Less mastication required.

(2) Calendering and extrusion operations carried out more smoothly.

(3) Less alteration in shape after calendering and extruding.

(4) Improved moulding.

(5) Spreading doughs require less solvent.

The details of the advantages of reclaim have been placed on record so often that there appears to be a tendency to accept them as well-established facts, but a search of the literature indicates that there is little published scientific evidence. A study of the properties of reclaim was therefore made by the staff of the London Advisory Committee for Rubber Research (Ceylon and Malaya) in order that quantitative data might be available. As the investigations proceeded it became evident that the advantages of using reclaim are not as definite as the constantly reiterated statements of the reclaim industry would lead one to suppose and in many cases the reclaim instead of being an aid to manipulation is a hindrance.

It is not proposed in this article to give details of the results obtained, as they have already been included in a paper on the effect of reclaim on the manipulation of rubber read before the London Section of the Institution of the Rubber Industry, March 13th, 1933. Altogether 22 samples of different grades of reclaim from six manufacturers were analysed and submitted to a series of tests by masticating with an equal weight of smoked sheet, mixing with various compounding ingredients and subjecting at

each stage to tests connected with manipulation. It was concluded that whereas there are only a few commercial grades of raw rubber, there are many grades of reclaim differing from each other in important respects. The samples examined might almost be regarded as constituting 22 different grades. No information was obtained as regards the uniformity of any of the grades, but reclaim is made from an assortment of scrap material which must inevitably change with the development of manufacturing practice, and so cause some variation in the nature of the finished reclaim.

The mixtures of rubber and reclaim sometimes required a much longer period of mastication to reach a fixed plasticity than rubber alone, and the better the quality of the reclaim the greater the adverse effect on mastication. The most beneficial effect was produced by the cheapest grade of reclaim, which reduced the period of mastication by about 20 per cent. when mixed with an equal weight of smoked sheet. Smaller proportions of reclaim had a similar effect, but in less degree. The cost of mastication is stated to be from $\frac{1}{4}$d. to $\frac{1}{2}$d. per lb. of rubber, so that the maximum economy in mastication effected by using a large proportion of any grade of reclaim does not exceed $\frac{1}{10}$d. per lb. of rubber and in the majority of cases there is an increase and not a decrease in mastication costs when raw rubber is replaced by reclaim.

After mastication in order to render the rubber soft and plastic, it is customary in manufacturing practice to mix in compounding ingredients as required. Owing to its origin, reclaim already contains considerable quantities of compounding ingredients, so that it is obvious that if rubber is replaced by reclaim the cost of incorporating the compounding ingredients already present in reclaim is saved. The use of reclaim, however, does not altogether eliminate the need for mixing. It is necessary, for example, to incorporate sulphur before it can be vulcanised, and it would be necessary to use large proportions of low-grade reclaim in order to effect an appreciable economy in the amount of milling required to incorporate the compounding ingredients for most mixings. It is not possible to do this without sacrificing the quality of the finished product. Mixing economies due to the use of reclaim are therefore limited to low-grade articles, in which high tensile strength and resistance to abrasion are not required.

After the incorporation of the compounding ingredients it is generally necessary to mould the rubber to the required shape either by passing through heated rolls known as a calender, or by forcing through a shaped die (extrusion). An argument for using small proportions of reclaim in high-grade rubber articles is that it enables calendering and extruding operations to be carried out more smoothly, and improves the moulding properties of the rubber. The experiments carried out in London failed to confirm the general truth of this argument. It was found that the most expensive grades of reclaim reduced the rate of extrusion of rubber mixings and only the cheapest grades effected an improvement. In addition the mixings without reclaim extruded more smoothly than those containing reclaim. Similarly other experiments in which the shape of the mixing was altered by direct pressure shewed that mixings containing reclaim were frequently more difficult to deform than those without. An interesting result of these experiments was the discovery that reclaim mixings required high loads to obtain the best deformation results relative to the corresponding mixings without reclaim. In other words, reclaim mixtures which were difficult to deform under low loads in comparison with the corresponding rubber mixings without reclaim might deform more easily under high loads. The practical importance of this fundamental difference in the properties of rubber and reclaim is difficult to estimate, but for some purposes it may be an advantage to have a material which moulds easily under high loads but does not alter in shape under low loads. Rubber manufacturers, however, have not suggested that there is difficulty in handling mixings without reclaim, and it seems likely that rubber without reclaim is sufficiently rigid under low loads for practical purposes.

Another striking difference between mixings containing reclaim and those without consisted in the extent to which they recovered from deformation. Reclaim is usually regarded as a "dead" material, and these experiments have confirmed that it reduces the "liveliness" of rubber mixings. This is a distinct advantage in manipulation, as it is easier to calender or extrude reclaim mixings to the required dimensions than similar mixings of raw rubber without reclaim.

On the whole the experiments have shewn that claims made on behalf of reclaim are too wide. It did not generally effect an economy in mastication and it did not improve calendering and

extruding. The only advantage which could be generally confirmed was that mixings containing reclaim are more "dead" than the corresponding raw rubber mixings without reclaim. It was also shown that good quality reclaim possessed advantages as regards deformation at high loads which it does not possess at low loads.

The main object of these experiments was not to test the validity of the claims made as regards the advantages of reclaim but to obtain quantitative data with a view to preparing raw rubber with properties similar to or better than reclaim.

There is one advantage of reclaim which it would probably not be economical for raw rubber to emulate. Owing to its origin reclaim contains considerable quantities of compounding ingredients. It is not likely that any proposal to incorporate a miscellaneous assortment of compounding ingredients with raw rubber in the East is likely to meet with approval, as manufacturers prefer to arrange their own compounding, and they have much better equipment for this purpose. Most of the compounding materials used are not produced in the East, and would therefore have to pay double transport costs if incorporated with rubber on the estates.

There are other directions in which it may be impossible or undesirable to duplicate the properties of reclaim. It has already been explained that, compared with crepe and sheet, reclaim is difficult to deform under low loads and easy to deform under high loads. This requires such a fundamental change in the nature of rubber that it is not likely to be obtained except by uneconomical means. There is the possibility that rubber could be hardened with compounding ingredients such as carbon black and rendered plastic with oil, and a patent has been taken out to prepare by this means a product resembling reclaim (Gaisman, E.P. No. 386,846, 1933). The process has the disadvantage that it involves the incorporation of compounding ingredients into rubber in the East.

It is possible, however, to imitate, and perhaps improve on the main virtue of reclaim, viz. deadness. This can be achieved by producing a more plastic and less elastic material. A more

plastic rubber would also have the advantage of requiring less mastication, more rapid extrusion, quicker calendering and easier moulding. It is considered that there would be a large market for this type of rubber, particularly if the vulcanising and ageing properties were maintained. Considerable progress has already been made in experiments with a view to producing this type of rubber, but so far it has not been possible to produce a type of rubber which will give vulcanised products under all circumstances equal in quality to those produced by crepe or sheet. The alternative is to compromise between vulcanising properties and ease of manipulation. There has been recently placed on the market a "softened" rubber (Ungar and Schidrowitz, E.P. No. 368,902, 1932) which is very easily manipulated and gives surprisingly good results under some circumstances when vulcanised. This product is prepared in Europe from crepe or sheet. What is needed, however, is a soft rubber with a distinctive and attractive appearance which can be produced economically in the East, and it seems likely that it is only a question of time before such a product is placed on the market.

# RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the thirteenth meeting of the Board of Management, held at 11 a.m. on Thursday, March 23, 1933, in Room No. 202, New Secretariat, Colombo.

*Present.*—Dr. W. Youngman (in the chair), Messrs. C. W. Bickmore, C.C.S., (Acting Financial Secretary), I. L. Cameron, C. E. A. Dias, J.P., A. E. de Silva, B. F. de Silva, H. R. Freeman, M.S.C., F. H. Griffith, J. L. Kotelawala, M.S.C., F. A. Obeyesekere, M.S.C., C. A. Pereira, B. M. Selwyn, G. K. Stewart, M.S.C., and E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director of Research, was present by invitation and acted as Secretary to the meeting.

Apology for absence was received from Mr. E. C. Villiers, M.S.C., and Colonel T. Y. Wright.

## MINUTES

Minutes of the meeting held on February 16, 1933, were confirmed and signed by the Chairman.

## BOARD

The resignation of Mr. James P. Fernando was reported.

## STAFF

It was decided that Mr. R. K. S. Murray, Mycologist to the Scheme, be asked to undertake duties as Botanist in addition to mycological work.

## ACCOUNTS

(a) The following items of expenditure in excess of estimates for 1932 were sanctioned:

General Charges Rs. 316·49.

London Advisory Committee Rs. 590·37. It was noted that Rs. 589·72 represents payments to Sundry Creditors in respect of 1931.

Depreciation of buildings and equipment in Ceylon and London Rs. 5,895·12.

Certain small items in excess of detailed estimates of the Experiment Station for 1932 were also sanctioned.

(b) *Accounts and Balance Sheet for 1932.*—The statement of income and expenditure and balance sheet for 1932 were considered. Income for the year amounted to Rs. 149,266 and expenditure on revenue account to

Rs. 82,232. Expenditure on capital account amounted to Rs. 8,662. Cash in hand at December 31, amounted to Rs. 219,904 of which Rs. 216,577 represents the available balance to be carried forward.

After discussion in which it was pointed out that the surplus account was greater than the actual cash balance owing to part of the surplus being invested in buildings etc., the accounts and balance sheet for 1932 were adopted.

(c) *Auditor General's Report.*—The report on the accounts and balance sheet for 1932 was adopted after a short discussion on points which had been raised in regard to depreciation of London plant etc.

## ANNUAL REPORT FOR 1932

After discussion and slight amendment the report was adopted. It was stated that the report of the London Advisory Committee for Rubber Research (Ceylon and Malaya) had been delayed owing to illness of the staff and would be submitted later.

It was decided to have the report printed in the same style as reports issued prior to 1931 and to enquire from the Hon'ble the Minister for Agriculture and Lands whether he wished to have extra copies printed for issue as a Sessional paper.

## DEVELOPMENT OF THE RESEARCH SCHEME

The report of the Committee which had been appointed to inspect three estates in the Kalutara district was considered together with offers from the proprietors of the estates. A full discussion took place regarding the merits of the estates, the price which should be paid for planted land under present conditions, and the area of Crown land which would be required for future development. On the proposal of Mr. B. M. Selwyn seconded by Mr. G. K. Stewart it was decided to make a firm offer for one of the estates at a price proposed by Mr. Freeman and seconded by Mr. Griffith.

## TECHNICAL OFFICERS' REPORTS

The following reports were tabled:

"Further yield records in connection with *Oidium Heveae.*"

"Diseases of rubber in Ceylon 1932."

Consideration of other items on the agenda was deferred until next meeting.

# RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the Fourteenth Meeting of the Board of Management, held at 11 a.m. on Thursday, May 18, 1933, in Room No. 202, New Secretariat, Colombo.

*Present.*—Dr. J. C. Hutson (in the chair), Mr. I. L. Cameron, Mr. C. E. A. Dias, J.P., Mr. E. L. Fraser, Mr. H. R. Freeman, M.S.C., Mr. L. P. Gapp, Mr. F. H. Griffith, Mr. C. A. Pereira, Mr. B. M. Selwyn, Mr. E. W. Whitelaw, Mr. E. C. Villiers, M.S.C.

Mr. T. E. H. O'Brien, Director of Research, was present by invitation, and acted as Secretary to the meeting.

Apology for absence was received from Mr. B. F. de Silva.

## BOARD

It was reported that Dr. W. Youngman had proceeded on home leave and that temporary Chairmanship of the Research Scheme had been assumed by Dr. J. C. Hutson as Acting Director of Agriculture.

The Chairman welcomed to the Board Mr. E. L. Fraser, nominated to act for Col. T. Y. Wright during the latter's absence from the Island and Mr. L. P. Gapp, nominated in place of Mr. G. K. Stewart, M.S.C., who had resigned owing to pressure of other duties. He proposed that a vote of appreciation of Mr. Stewart's services to the Board be recorded.—Carried.

## MINUTES

Minutes of the meeting held on March 23, 1933, were confirmed and signed by the Chairman.

## ACCOUNTS

Statements of receipts and payments of the Board and of the London Advisory Committee for the quarter ended March 31, 1933, were adopted without discussion. Receipts for the quarter amounted to Rs. 44,217/- and payments to Rs. 27,974/-.

Statements of expenditure on the Experiment Station for January, February and March, 1933, were tabled.

Fixed deposits made since last meeting were reported, as follows: Renewals Rs. 40,000/-, New deposits Rs. 40,000/-.

## RECOGNITION OF PROVIDENT FUND UNDER THE INCOME-TAX ORDINANCE

It was reported that further correspondence with the Income Tax Department had indicated that there was no disadvantage in approval of the Fund under Section 9 (1) (g) of the Ordinance and that the officers of

the Scheme were in favour of the fund being approved. This decision was endorsed and the Chairman authorized to sign the undertaking required by the Income Tax Department.

## LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON & MALAYA)

(a) Minutes of the following meetings were adopted :—

Advisory Committee minutes of meetings held on October 28, 1932 and January 27, 1933.

Technical Sub-Committee minutes of meetings held on October 28, 1932 and January 27, 1933.

Sub-Committee on Staff minutes of meetings held on November 18, 1932 and January 13, 1933.

(b) The Report of the London Advisory Committee for 1932 was adopted subject to amendment of a sentence in the technical appendix referring to unsmoked sheet. Before printing the report it was decided to enquire whether it had been adopted by the Rubber Research Institute of Malaya and to inform them of the proposed amendment.

## DEVELOPMENT OF THE RESEARCH SCHEME

The Chairman reported that the offer for the estate made on behalf of the Board had been declined. The correspondence indicated that the Proprietor would be prepared to consider a further offer. After discussion it was unanimously decided to appoint a small Committee to meet the Proprietor of the estate and ascertain the lowest price at which the property could be acquired. The following Committee was appointed with instructions to report to the Board at a meeting to be held on June 15, 1933 :—Messrs. B. F. de Silva, L. P. Gapp and T. E. H. O'Brien.

## CONCENTRATION OF LATEX

It was decided to defer consideration of the purchase of an experimental machine for latex concentration until policy regarding the purchase of an estate and appointment of additional staff has been settled.

## BROADCASTING

A letter from the Broadcasting Advisory Board inviting the Research Scheme to arrange a series of broadcasting talks was read. It was decided to inform the Advisory Board that a series of talks would be arranged at a later date.

## TECHNICAL REPORTS

Technical Officers' reports for January, February and March, 1933, were adopted after discussion.

# RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the Fifteenth Meeting of the Board of Management of the Rubber Research Scheme (Ceylon) held at 11 a.m. on Thursday, June 15, 1933, in Room No. 202, New Secretariat, Colombo.

*Present.*—Dr. J. C. Hutson (in the chair), Mr. C. W. Bickmore, C.C.S., (Deputy Financial Secretary), Mr. I. L. Cameron, Mr. C. E. A. Dias, J.P., Mr. A. E. de Silva, Mr. B. F. de Silva, Mr. H. R. Freeman, M.S.C., Mr. L. P. Gapp, Mr. F. H. Griffith, Mr. C. A. Pereira, Mr. B. M. Selwyn, Mr. E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director of Research, was present by invitation, and acted as Secretary to the meeting.

Letters of apology for absence were received from Messrs. E. C. Villiers, M.S.C., and E. L. Fraser.

## MINUTES

Minutes of the meeting held on May 18, 1933, were confirmed and signed by the Chairman.

## ANNUAL REPORT

The Chairman reported a decision, by circulation of papers, to have the annual report printed in the style and size suitable for Government requirements.

## ACCOUNTS

(a) A supplementary estimate for manuring at the Experiment Station, Nivitigalakele, was considered. After discussion it was decided not to proceed with the proposal on the grounds that regular manuring of clearings is not a feasible estate practice and that test tapping results would not be representative.

(b) The following fixed deposit was reported: Renewal Rs. 10,000/-.

(c) Experiment Station accounts for April 1933, were tabled.

## LETTER FROM RUBBER-GROWERS' ASSOCIATION

The Chairman read a letter from the Secretary of the Rubber Growers' Association stating that it is proposed to forward copies of the proceedings of the Technical Research and Development of New Uses Committee to the Director of the Research Scheme for information. He reported that a copy of the latest report had been received.

## LONDON ADVISORY COMMITTEE

Minutes of the following meetings were considered and adopted:

London Advisory Committee minutes of meeting held on March 31, 1933.

Technical Sub-Committee minutes of meeting held on March 31, 1933.

## DEVELOPMENT OF THE RESEARCH SCHEME

(a) The Chairman reported that the Committee appointed at the last meeting had not yet met the Proprietor of the estate which is under consideration. A meeting was being arranged for the following week.

(b) A provisional estimate of the cost of development, apart from the purchase of an estate, was considered. After discussion it was decided to adopt the estimate as a rough guide to the cost of development.

(c) The proposal to strengthen the chemical staff of the Scheme was brought up for further consideration. After discussion it was decided to advertise both locally and abroad for an Assistant Chemist for work in connection with the preparation and utilisation of raw rubber.

## TECHNICAL REPORTS

(a) Technical officers' reports for April, 1933, were considered and adopted.

(b) The following reports were tabled.—

"Ceylon Clones. I".—R. K. S. Murray.

"A Note on Sun-scorch of Budgrafts".—R. K. S. Murray.

"The Use of Reclaim in Rubber Manufacture".—G. Martin.

## PUBLICATIONS

*1st Quarterly Circular* for 1933 was tabled.

## YIELDS OF BUDDED RUBBER

A member urged the necessity for the Rubber Research Scheme to enquire from every likely source as to reliable figures of yields from large areas of budded rubber.

He stated that to date, published results had been based almost entirely on the yield of a few trees only, and this had caused proprietors to hesitate before embarking on budding programmes of any appreciable size. He considered that if the yield from large acreages could be made known it would greatly increase interest in this aspect of planting. The Director of Research undertook to make enquiries.

# RUBBER RESEARCH SCHEME (CEYLON)

## LIST OF PUBLICATIONS FOR SALE.

**Bulletins at Rs. 1-00 per copy.**

No. 1. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis.
No. 2. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis.
No. 3. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis Part I.
No. 4. The Physiological Effects of Various Tapping Systems, Part I.
No. 5. Progress Report on Vulcanization Tests
No. 6. The Physiological Effects of Various Tapping Systems, Part II.
No. 7. Do Do Do Part III
No. 8. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part II.
No. 9. Vulcanization Tests.
No. 10. Do.
No. 11. Variability in Rubber Manufacture.
No. 12. Progress Report of the Rubber Research Chemist.
No. 13. Vulcanization Tests.
No. 14. On the Variation in the Number of Latex Vessels present in Hevea brasiliensis.
No. 15. Vulcanization Tests.
No. 16. On the Natural Clotting of Rubber Latex.
No. 17. Vulcanization Tests.
No. 18. Measurements of "Bark Renewal."
No. 19. Vulcanization Tests.
No. 20. Do.
No. 21. Do.
No. 22. Do.
No. 23. Do.
No. 24. Do.
No. 25. Investigations on Samples of Plantation Para Rubber from Ceylon.
No. 26. Results of Trials of Ceylon Plantation Rubber for the manufacture of Ebonits.
No. 27. Investigations on Samples of Plantation Para Rubber from Ceylon.
No. 28. Do.
No. 29. Summary of the Principal Results obtained from Investigations into the Properties of Ceylon Plantation Rubber in relation to its Method of Preparation.
No. 30. The penetration of disinfectant on the tapping cut of Hevea brasiliensis.
No. 31. On the Occurrence of "Rust" on Sheet Rubber.
No. 32. On the Preservation of Latex.
No. 33. Investigations on Samples of Plantation Para Rubber from Ceylon.
No. 34. Do.
No. 35. Do.
No. 36. Do.
No. 37. Do.
No. 38. Do.
No. 39. Do. (Final Report Series I.)
No. 40. Do Series II.
No. 41. Do. First Interim Report on artificial ageing tests.
No. 42. On the Smoking of Sheet Rubber in relation to Mould Prevention.
No. 43. The inter-relationship of Yield and the various Vegetative Characters in Hevea brasiliensis.
No. 44. The Construction of Smokehouses for Small Rubber Estates.
No. 45. The Efficiency of Disinfectants and Fungicides.
No. 46. The Control of Bark Rot by Disinfectants.
No. 47. Report on Variability of Ceylon Estate Grades.
No. 48. Brown Bast and its Treatment.
No. 49. Report on Causes of Variation in Plasticity.
No. 50. Crepe Rolling.
No. 51. The Curing of Sheet Rubber.
No. 52. The Preparation of Uniform Rubber.

**Booklets at Rs. 2-50 per copy.**

Guide to the Preparation of Plantation Rubber, by T. E. H. O'Brien, M.Sc., A.I.C., Chemist.
The Budding of Rubber, by R. A. Taylor, B.Sc., Physiological Botanist.
Diseases of Rubber in Ceylon, by R. K. S. Murray, A.R.C.Sc., Mycologist.